

Software for Architecture, Engineering and Construction



CYPETHERM LOADS

Practical Example

Thermal load calculation of buildings according to the Radiant Time Series Method (RTSM), proposed by ASHRAE.





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The CYPETHERM LOADS programme allows the calculation of thermal loads in buildings and is integrated into the Open BIM workflow. It allows the import and synchronisation of BIM models (IFC4) generated by CAD/BIM programmes. It includes the ASHRAE Weather Data Viewer 6.0 that provides weather data from 8118 stations all over the world.

It has several material databases, including the material database for the Portuguese LNEC (Laboratório Nacional de Engenharia Civil) and those from the EN ISO 10456 code. It incorporates the ISO 6946 and ISO 10077-1 codes for calculating thermal transmission coefficients and the ISO 13370 code for calculating thermal transmission coefficients of elements in contact with the ground.

Automatic shading from the IFC file import. It allows edges to be detected in the BIM model and their corresponding linear thermal bridges to be generated automatically, depending on the construction systems chosen and the building description from a thermal calculation point of view (zones, space descriptions, etc.).

Transmission coefficients for linear thermal bridges can be obtained from the ISO 14683 code catalogue or calculated via a finite element calculation in accordance with the ISO 10211 code.

The Radiant Time Series (RTS) method proposed by ASHRAE for calculating heating and cooling loads or the one specified in the EN 12831 code for calculating heating loads can be selected. This document includes a practical example that allows users to put the programme's routine commands and procedures into practice.



1 **Project development**

Data entry is carried out via linking to a BIM project which has been previously created with a BIM model generation programme or with the free IFC Builder programme.

	BIMserver.center	Туре	Name	Account
	Server Cericer		Hostal	Usuario
			_borrar	Usuario
	www.bimserver.center		- Offices Project	Usuario
			CITY HALL	Usuario
	Usuario		Retail Project	Usuario
	Connected		Business School	Usuario
		•••	Case Study House No. 8 - Ray and Charles E	Usuario
V8J			Hotel Project	Usuario
	Stop synchronisation			
Laurieri automa	acaiy apon starting windows			
Ē	Store local copy in: c:\bim_projects			
				0
	Issues			
ame Projects	loodoo			

The following order of data entry is recommended:

- 1. Creating the architectural model.
- 2. **Creating the thermal load model.** Data is read by importing the BIM model.
- 3. **Defining the spaces.** With interior design conditions.
- 4. **Defining the construction systems.** It is useful for users to have libraries, this way, in the IFC file import phase, the **Directory for searching typologies** option can be activated. If the construction systems defined in the BIM model have the same reference as those in the library, they will be defined automatically. If the reference does not exist in the library, the element may be defined by the user, and it can even be



exported to their library so that it becomes part of it and can be used in future projects. All imported elements can be edited.

- 5. **Edges processing.** Calculating linear thermal transmission coefficients according to the defined configuration.
- 6. **Defining the calculation model.** Configuring calculation options and climate data.
- 7. **Building zoning.** Creating various zone hypotheses for the building to be used in the calculation.
- 8. **Calculation and analysis of results.** After clicking on **Update results**, results can be analysed, and result documents can be obtained and exported to the BIM model.

2 Creating the architectural model

2.1 BIMserver.center

This example uses an architectural BIM model from CYPE's free architectural modelling programme, IFC Builder.

The process of exporting an architectural BIM model by generating an IFC file in BIMserver.center from IFC Builder is explained below. If you have not yet registered on this platform <u>http://bimserver.center/</u>, you must do so in order to log in using an email address and password.

2.2 IFC Builder

The example starts with the IFC Builder programme.

- Run 🄎 IFC Builder.
- Click on the 🞯 Examples icon.
- Select the Offices file.
- In the top right corner, click on **Share** and **Project selection**.



	Export to BIM project	×
8	BIMserver.center With BIMserver.center you can manage, share and update your architecture, engineering and construction projects in the cloud. Additionally, using Open BIM technology, they can be integrated into a collaborative, open and coordinated work amongst all the technical designers that are part of the work team. BIMserver.center Store	kflow
<mark>∠ L</mark> ink to a	BIM project	
Project selection Remember ('Open BIM During the	Link: BIMserver.center Project: - Main (initiator): Offices Architectural Model.ifc r that to able to develop the project in a coordinated manner between the different application /' workflow), the initial IFC file (generated by 'IFC Builder') should be saved in an empty director · consolidation process carried out by the applications, all the IFC files which constitute the project is composed of all the files in the directory to which the BIM link is in the directory to which the directory to which the BIM link is in the directory to which the BIM link is in the directory to which the dir	ory. oject
DXF-DWG	•	
<u>A</u> ccept	C	ancel

• Fill in the data according to the figure below.

New project	×
Project name	
Offices - Practical example	
Type of project	
Courses and seminars	-
View options	
Closed	-
Management of collaboration requests	
Closed] - [
Description	
	*



	Export to BIM project	×
8	BIMserver.center With BIMserver.center you can manage, share and update your architecture, engineering and construction projects in the cloud. Additionally, using Open BIM technology, they can be integrated into a collaborative, open and coordinated workf amongst all the technical designers that are part of the work team. BIMserver.center Store	low
🗹 Link to a	BIM project	
Project selection Remember ('Open BIM During the	Link: BIMserver.center Project: Offices - Practical Example Main (initiator): Offices Architectural Model.ifc That to able to develop the project in a coordinated manner between the different applications I' workflow), the initial IFC file (generated by 'IFC Builder') should be saved in an empty director consolidation process carried out by the applications, all the IFC files which constitute the projed, assuming that the project is composed of all the files in the directory to which the BIM link is I.	у.
DXF-DWG	•	
<u>A</u> ccept	Car	ncel

Click on **Create new project**, and set the project name to "Offices – Practical example".

- A new window with exportation information will appear, click **Accept**.
- To confirm whether the project is in BIMserver.center, click on the icon 🛞 in the Windows taskbar next to the clock and date displayed onscreen.
- If this icon does not appear, click on CYPE's general menu in the Open BIM group and then on **BIMserver.center** to activate it.
- The BIMserver.center platform may also be accessed directly.



2.3 Description of the building

The office building consists of 5 floors. On floor 0 (ground floor) there is a dining room and an office. Floors 1 to 3 consist of offices and meeting rooms. Technical areas (machine room, etc.) are located on floor 4. Floor 5 is the roof.

2.4 Creating the lighting model

The CYPETHERM LOADS programme allows lighting data to be entered manually, but it also allows the same data from the lighting model created in CYPELUX to be entered automatically.

Start with the CYPELUX programme.

- Run CYPELUX.
- Click on the **Examples** icon and select Offices.
- In the top right-hand corner, click on **Update**.
- Click on **Project selection** and select the Offices Practical example project.

		1	Update BIM model			□ ×
Project selection		erver.center ces - Practical example				
Select the	files you want to	o include				
Import	Туре	Application/Program	Project	Description	Date	Changes
✓	Initiator ~	IFC Builder	Offices Architectural Model.ifc		2021/10/21 07:21:42	New
	ents in the curre le in the calculat	nt BIM model ion model the new BIM r	 model elements			^
Modified e	elements in the	current BIM model				
🗸 Updat	e calculation mo	odel elements that have l	been modified in the BIM model			
Updat	e the calculation	n model elements even if	they have been modified			
Recov	Recover deleted items from the calculation model					
				G	eographic location and refe	rence system
<u>A</u> ccept]					Cancel



• In the top right-hand corner, click on **Share**. The programme will ask whether you wish to update the results before exporting the information. Click on **No**.

File to be exported in IFC format	×
Generate the application results and upload them as a contribution to the project located on Bimserver.center.	
Name	
Offices - Practical example CYPELUX	
Description	
CYPELUX	ŝ
Additional files	
☑ Quantities	
🗹 Design annex	
✓ Reports	
DXF/DWG drawings	
Accept	ancel

Information with lighting data, light positioning and reports was exported to the *"Offices - Practical example"* BIM project on the BIMserver.center platform.

3 Creating the thermal loads model

3.1 Creating the file

Start the CYPETHERM LOADS programme.

- Run 筐 CYPETHERM LOADS.
- Click on **File/New**. In the pop-up window, enter a job name.



New job	×
Job name	
D:\CYPE Ingenieros\Examples\CYPETHERM LOADS\	Browse
File name Offices - Practical example	.hva
Description	
Accept	Cancel

4 Linking to a BIM project

A new window opens, allowing users to either link to an existing BIM project on the BIMserver.center platform or create a new one.

New job	×
Connected as:	
Usuario	
Select project Create new project	
Project:	
www.bimserver.center	
<u>A</u> ccept	ncel

- Click on **Select project**.
- Select the previously created "Offices Practical example" job and click on Accept.



The configuration window for importing the BIM template will be displayed.

		Import of BIM models		□ ×	
Project selection	Project: Offic Main (initiator): Offic	server.center ces - Practical example ces Architectural Model.ifc			
Select the	files you want to includ	e			
Import V	Application/Program CYPELUX	Project Offices - Practical example CYPELUX	Description CYPELUX	Date 2021/10/21 09:20:58	
Edges / Sh	ading generation				
🗹 Impor	t edges			0	
Locati	ate the shadow descript on data Northern hem the location of the BIM	·		3	
<	< Geographic location and reference system				
<u>A</u> ccept	Accept				

The **Directory for searching typologies** option allows users to indicate the location of their Library, which they will have developed over time.

If the construction elements defined in the BIM model have the same reference as those in the library, they will be defined automatically. If the reference does not exist in the library, the element must be defined by the user, who can even export it to their existing library so that it can be added and then used in future projects. All imported elements may be edited.

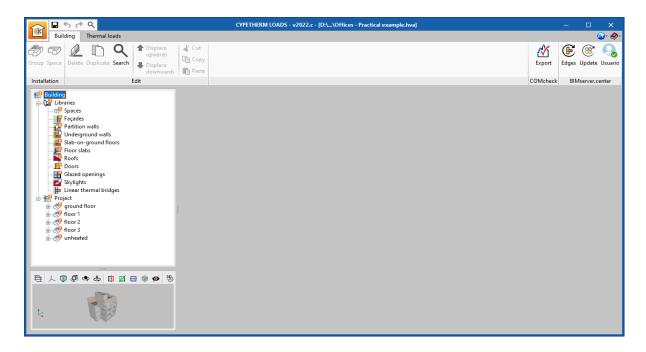
In this example, the address where the library is located will not be specified, as the intention is to show the manual creation of all the elements. However, during the process of this example, it is shown how to create this user library.

Keep the default options according to the figure above and click **Accept**.

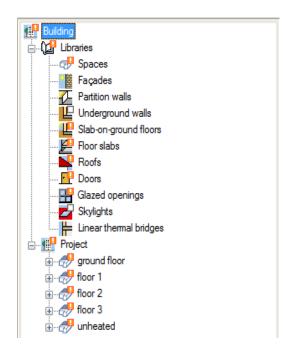


4.1 Building information

Building information (zones, spaces, construction elements) has been imported and can be viewed in tabular form on the left-hand side and underneath in a 3D view.



In the structure, some elements are highlighted with an exclamation mark . This means that some parameters must be defined by the user. If the path for the user library had been indicated during the import process and if these element types had been present, these exclamation marks would not have appeared, just as mentioned above.





5 Defining spaces

Click on **Spaces**. The space types in the building will appear.

	Reference
1	Office
2	Lift
3	Risers
4	WC
5	Comdor
6	Meeting room
7	Dining
8	Hall
9	Stairs
10	Technical room

5.1 Office

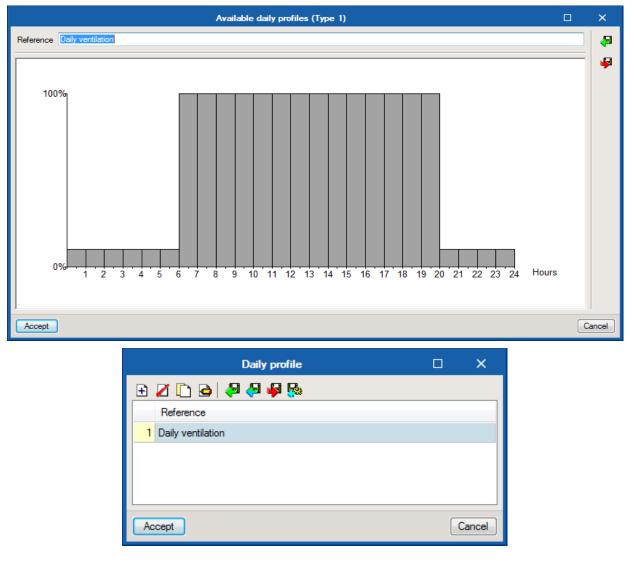
- Click or double click on **Edit**, with the *Office* space type selected.
- Activate the **Ventilation** option.
- Click on **(**, select the **Office Buildings** and **Office space** options.

Minimum ventilation Rates in Breathing Zone 🛛 🛛 🗙						
Correctional Facilities	Import	Overview	Flow per person ((1/s)/person)			
Educational Facilities		Breakrooms	4			
Food and Beverage Service		Main entry lobies	6			
🔘 General		Occupiable storage rooms for dry materials	18			
Hotels, Motels, Resorts, Dormitories		Office space	9			
Office Buildings		Reception areas	4			
Miscellaneous spaces		Telephone/data entry	3			
 Public Assembly Spaces 						
🔘 Retail						
Sports and Entertainment						
Source: ANSI/ASHRAE Standard 62.1-2013						
Accept			Cancel			

• Activate the **Schedule** option in the *Ventilation* section.



- Click on **Available daily profiles** to create a specific profile.
- Click + Add a new element to the list.
- Type "Daily ventilation" into the **Reference**.
- Position the cursor and dick consecutively to create a profile according to the figure below, from 6 to 20 hours ventilation will be 100%, for the remainder of the period, it will be 10%.



- In the *Type* column, click on **Constant percentage** and select **Daily profile** which, in this case, corresponds to the ventilation profile. The same applies to all months. They can be selected at the same time.
- Click on 差 **Export** to import to other spaces and projects later on.



• Type in the *File* name.

	Schedule			×
Reference Annu	ual Ventilation			49
Month	Туре	Value		4
V January	Daily profile	Daily ventilation		
February	Export the element	nttoafile X		
March	Work directory			
🔽 April	C:\CYPE Ingenieros\Libra	ary 🔁		
🔽 May			_	
✓ June	File Annual Ventilation			
July		.matcyp	e	
V August			7	
September	Accept	Cancel		
Cctober	Daily profile	Daily ventilation		
November	Daily profile	Daily ventilation		
December	Daily profile	Daily ventilation		
Accept			C	ancel

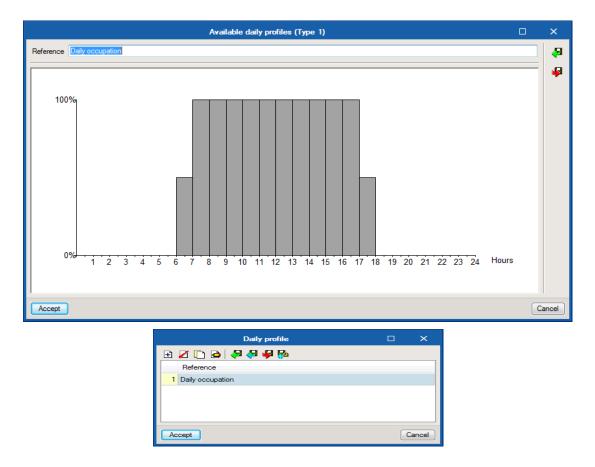
- Returning to the *Space* window, activate the **Internal heat gains** option and then **People**.
- Click on **People**, select the **Office Buildings** and **Office space** options.



- Keep the remaining default options.
- Activate the **Schedule** option, related to the *People*.
- Click on + Add to add a new element to the list and type in a *Reference* name.



• Position the cursor and click consecutively to create a profile according to the following figure.



In the *Type* column, dick on **Constant percentage** and select *Daily profile*. The same applies to all months.

	Schedule						
Reference Annual occupation							
Month	Туре	Value		÷			
January	Daily profile	Daily occupation					
February	Constant percentage 👻	100.00 %					
March	Constant percentage Daily profile	100.00 %					
April	Constant percentage	100.00 %					
V May	Constant percentage	100.00 %					
June	Constant percentage	100.00 %					
July	Constant percentage	100.00 %					
V August	Constant percentage	100.00 %					
September	Constant percentage	100.00 %					
Cctober	Constant percentage	100.00 %					
Vovember	Constant percentage	100.00 %					
December	Constant percentage	100.00 %					
Accept			C	ancel			



- Click on 🖊 **Export** to import into other spaces or other jobs later on.
- Type in a *File* name and double-click **Accept**.

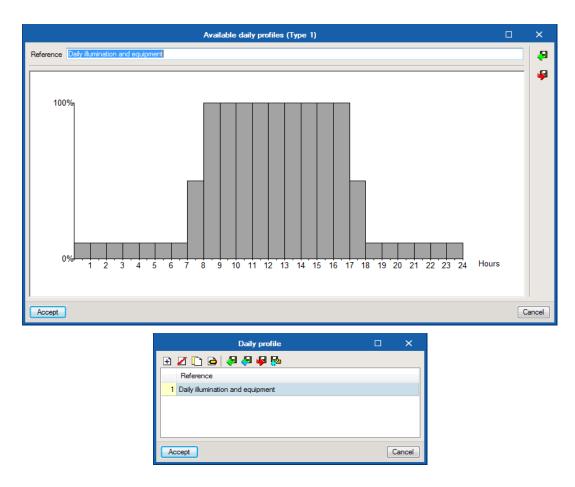
Export the element to a file	×
Work directory	
C:\CYPE Ingenieros\Library	
File	
Annual occupation	
	.matcype
Accept	Cancel

- Returning to the *Space* window, activate the **Internal equipment** option.
- Click on < Internal equipment and select the Medium option.

Recomm	ended load factors for various types of offices			×
Load density of	office	Mediu	m	•
Source: Jeffrey D.Spitler.	Load Calculation Applications Manual. ASHRAE. ISBN	978-1-9337	42-72-4	4 (2010)
Accept				Cancel
	✓ Internal equipment			
	Sensible heat gain 10.80 W/m² 🔻			
	Radiant fraction 0.20			
	Latent heat gain 0.00 W/m ² -			
	Schedule			

- Activate the **Schedule** option, related to the **Internal equipment**.
- Click on Available daily profiles to create a new profile.
- Click on + Add to add a new element to the list and type in a *Reference* name.
- Position the cursor and dick consecutively to create a profile according to the figure below, from 18 to 7 hours, lighting and equipment will be at 10%; from 7 to 8, and from 17 to 18 hours, lighting and equipment will be at 50%; and from 8 to 17 hours, it will be at 100%.





• In the *Type* column, click on **Constant percentage** and select *Daily profile* which, in this case, corresponds to the ventilation profile. The same applies to all months.

	Sched	ule		×
Reference				P
Month	Туре	Value		4
January	Daily profile	Daily illumination and equipment		
February	Daily profile	Daily illumination and equipment		
March	Daily profile	Daily illumination and equipment		
April	Daily profile	Daily illumination and equipment		
🔽 May	Daily profile	Daily illumination and equipment		
June	Daily profile	Daily illumination and equipment		
🔽 July	Daily profile	Daily illumination and equipment		
August	Daily profile	Daily illumination and equipment		
September	Daily profile	Daily illumination and equipment		
Cctober	Daily profile	Daily illumination and equipment		
Vovember	Daily profile	Daily illumination and equipment		
December	Daily profile	Daily illumination and equipment		
Accept			C	ancel



- Click on 差 **Export** to import to other projects later on.
- Type in the File name "Annual illumination and equipment".

Export the element to a file	×
Work directory	
C:\CYPE Ingenieros\Library	
File	
Annual illumination and equipment	
	.matcype
Accept	Cancel

- Returning to the *Space* window, activate the **Lighting** option.
- Click on < Lighting, select the Office and Downlight compact fluorescent luminaire options.

	Lighting					
	Sensible heat gain Radiant fraction Space fraction	150.00 W - 0.60 0.50				
	Lighting power de	nsities			×	
Building area type		Offic	e		-	
Luminaire category	1	Downlight compact flu	ioresce	nt luminaire	-	
Source: Jeffrey D.Spitler, Load Calculation Applications Manual. ASHRAE. ISBN 978-1-933742-72-4 (2010) ANSI/ASHRAE/IES Standard 90.1-2013						
Accept				C	Cancel	

- Activate the **Schedule** option.
- As this profile is the same as the profile defined earlier for the internal equipment, click on *Import*.
- Select the *Internal equipment* profile and click on **Accept**.

Import	×
Work directory	
C:\CYPE Ingenieros\Library	
File	
Annual illumination and equipmen	it 🔻
r	natcype
Accept	Cancel



Space (Type 1)	×
Reference Office	-
Space classification Occupied]
Calculation conditions Heated and cooled	
Cooling Heating	
Design indoor temperature 24.0 °C Design indoor temperature 21.0 °C	
Design relative humidity 50.00 % Design relative humidity 30.00 %	
Ventilation/Infiltration	j l
Ventilation 9 (1/s)/person -	
Heat recovery	
Schedule	
Internal heat gains	j
People 20.0 m²/person V V Internal equipment	
Sensible heat gain 70.00 W/person Sensible heat gain 10.80 W/m ² -	
Radiant fraction 0.60 🖨 Radiant fraction 0.20	
Latent heat gain 45.00 W/person Latent heat gain 0.00 W/m ²	
Schedule	
✓ Lighting	
Sensible heat gain 8.80 W/m² -	
Radiant fraction 0.97	
Space fraction 0.18	
]]
Accept	Cancel

Next, users will want to export the *Offices* space type to their library. This will allow them, in this example, to import their features to other space types. On the other hand, it means that data will not have to be redefined in future projects.

• Click on 🖊 **Export**, type in the name *"Office"* and click **Accept**.



5.2 Meeting room

As this space type has the same features as the **Offices** type, the **Offices** type is imported from the library and then renamed "Meeting Room".

- Select the space for the meeting room and click on 🖉 Edit.
- Click on 🐖 Import, select Offices and click on Accept.
- Change the **Reference** to "Meeting room" and click on **Accept**.
- The **Occupant density** will be higher, so enter 5 m²/person.
- Click on 差 **Export** this new space type for use in future projects.

5.3 Corridor

- Double click (or click on Corridor space type.
- Activate the **Ventilation** option.
- Click on < and select the **Office Buildings** and **Main entry lobbies** options.

Minimum ventilation Rates in Breathing Zone					
O Correctional Facilities	Importar	Descrição	Caudal por pessoa ((1/s)/pessoa)		
O Educational Facilities		Breakrooms	4		
○ Food and Beverage Service	✓	Main entry lobies	6		
◯ General		Occupiable storage rooms for dry materials	18		
O Hotels, Motels, Resorts, Dormitories		Office space	9		
Office Buildings		Reception areas	4		
		Telephone/data entry	3		
O Public Assembly Spaces					
Retail					
O Sports and Entertainment					
Source: ANSI/ASHRAE Standard 62.1-2013					
Aceitar			Cancelar		

• Activate the *Schedule* option in the **Ventilation** section.



- Click on **Import** and select the *Ventilation* profile from the library. Click **Accept**.
- Returning to the *Space* window, activate the **Infiltration** option, type in 19 l/s.

	Ventilation/Infiltration					
	Ventilation	6	(l/s)/person 🔻	✓ Infiltration	19	[/s ▼
l	Heat recovery			Only with nil ventilation		
	Schedule					

- Activate the Internal heat gains/People option.
- Click on
 select the Office Buildings and Main entry lobbies options and click Accept.
- Click on
 in Heat gains, select the Moderately active office work (offices, hotels, apartments) option.

Represent	ative states of activity	□ ×
Degree of activity	Moderately active office work (offices, hotels	, apartments) 🗸 🗸
Percentage of men, women an Percentage of women Percentage of children	d children Adjusted Male/Female	e heat gain V 50.00 % 50.00 %
Source: Jeffrey D.Spitler. Load Calculati	on Applications Manual. ASHRAE. ISBN 978-1-	933742-72-4 (2010) Cancelar
People Sensible heat g Radiant fraction Latent heat gai	0.58	

• Activate the **Schedule** option for *People*.



- Click on **Import** and select the *People* profile from the library.
- Returning to the *Space* window, activate the **Internal equipment** option.
- Click on 🔄 in Internal equipment, select the Light option.

Internal equipment		
Sensible heat gain	5.40 W/m² -	
Radiant fraction	0.20	
Latent heat gain	0.00 W/m² 🔻	
Schedule		

- Activate the **Schedule** option for the **Internal equipment**.
- Click on Figure 1 Click on Click on Click on Click on Figure 1 and select the *Internal equipment* profile from the library.
- Returning to the *Space* window, activate the **Lighting** option.
- Click on
 In Lighting, select the Office and Downlight compact fluorescent luminaire options.

✓ Lighting		
Sensible heat gain	8.80 W/m² -	
Radiant fraction	0.97	
Space fraction	0.18	
Schedule		

- Activate the **Schedule** option for **Lighting**.
- Click on **Import** and select the *Lighting* profile from the library.



Space (Type 5)	×
Reference Corridor	8
Space classification Occupied]
Calculation conditions Heated and cooled	
Cooling Heating]
Design indoor temperature 24.0 °C Design indoor temperature 21.0 °C	
Design relative humidity 50.00 % Design relative humidity 30.00 %	
Ventilation/Infiltration	
Ventilation 6 (I/s)/person - Infiltration	
Heat recovery	
✓ Schedule	
✓ Internal heat gains	
People 10.0 m²/person - Internal equipment	
Sensible heat gain 75.00 W/person Sensible heat gain 5.40 W/m ² -	
Radiant fraction 0.58 Radiant fraction 0.20	
Latent heat gain 55.00 W/person Latent heat gain 0.00 W/m ² -	
✓ Schedule	
✓ Lighting Miscellaneous loads	
Sensible heat gain 8.80 W/m² 🔻	
Radiant fraction 0.97	
Space fraction 0.18	
Accept	Cancel

- Next, users will want to export the *Corridor* space type to their library. This will allow, in this example, their features to be imported to other space types. On the other hand, it means that data will not have to be redefined in future jobs.
- Click on 📕 **Export**, type in the name *Corridor* and click **Accept**.



5.4 Hall

As it shares the same features as the *Corridor* space type, the aim is to import the **Corridor** type from the library and then change its name.

- Double click or select the *Hall* space type and click on 🖉 **Edit**.
- Click on 🗧 Import, select *Corridor* and click on Accept.
- Change the reference to *Hall* and click on **Accept**.

5.5 Risers

- Classify the space as *Non-habitable*.
- Type in the data according to the figure below.

Space (Type 3)	×
Reference Risers	\$
Space classification Not occupied	¥
Losses reduction factor 'b'	
Calculated	
© Custom	
Air tightness	
Completely airtight	
Without ventilation openings	
Small ventilation openings	
Permanent ventilation openings	
C Large or numerous ventilation openings	
© Custom	
Not airtight due to some localised open joints or permanent ventilation openings $(3\slashh)$	
Accept C	ancel

5.6 Stairs

• Follow the same procedure as for *Risers*.



5.7 Lift

• Follow the same procedure as for *Risers*.

5.8 WC

• Follow the same procedure as for *Risers*.

5.9 Dining

As it shares the same features as the *Corridor* space type, the aim is to import the *Corridor* type from the library and then change its name.

- Select the *Dining* space type and click on **Edit**.
- Activate the **Ventilation** option.
- Click on
 select the Food and Beverage Service and Restaurant dining rooms options.

Correctional Facilities	Importar	Descrição	Caudal por pessoa ((1/s)/pessoa
Educational Facilities	V	Restaurant dining rooms	5
Food and Beverage Service		Cafeteria/fast-food dining	5
General		Bar, cocktail lounges	5
Hotels, Motels, Resorts, Dormitories		Kitchen (cooking)	7
Office Buildings			
Miscellaneous spaces			
Public Assembly Spaces			
Retail			
) Sports and Entertainment			

- Activate the **Schedule** option in *Ventilation*.
- Click on **Import** and select the *Ventilation* profile from the library. Double-click **Accept**.
- Returning to the *Space* window, activate the **Internal heat gains** option.
- Activate the **People** option.



- Click on **People**, select the **Food and Beverage Service** and **Restaurant dining rooms** options.
- Click on the **Heat gains** in *People*, select the **Sedentary work (restaurant)** option.

Representat	tive states of activity			×				
	Sedentary work (restauran							
Percentage of men, women and o	children Adj	justed Male/Female he	at gain	~				
Percentage of women			50.0	% 00	V People	1.4 m²/pe	erson 🔻	-
Percentage of children			50.0	00 %	Sensible heat gain	80.00	W/person	
Source:					Radiant fraction	0.58		
Jeffrey D.Spitler. Load Calculation	Applications Manual. ASH	RAE. ISBN 978-1-933	742-72-4	(2010)	Latent heat gain	80.00	W/person	
Aceitar			Car	ncelar	Schedule			ð

- Activate the **Schedule** option for the *People*.
- Click on **Import** and select the *People* profile from the library. Double-click **Accept**.
- Returning to the *Space* window, activate the **Internal equipment** option.
- Click on < in Internal equipment, select the Light option.

✓ Internal equipment	
Sensible heat gain	5.40 W/m² -
Radiant fraction	0.20
Latent heat gain	0.00 W/m² 🔻
Schedule	Þ

- Activate the **Schedule** option for the *Internal equipment*.
- Click on Figure and select the *Internal equipment* profile from the library. Doubleclick **Accept**.
- Returning to the *Space* window, activate the **Lighting** option.



Click on in Lighting, select the Dining: Cafeteria/fast food option and Downlight compact fluorescent luminaire.

Lighting power de	nsities		×			
Building area type	[Dining: Cafeteria/fast foo	d ~	✓ Lighting		
Luminaire category	Downlight compa	act fluorescent luminaire	~	Sensible heat gain	10.90 W/m² -	
Source: Jeffrey D.Spitler. Load Calculation Applications	Manual. ASHRAE.	ISBN 978-1-933742-72-4	(2010)	Radiant fraction	0.97	
ANSI/ASHRAE/IES Standard 90.1-2013				Space fraction	0.18	
Aceitar		Ca	ncelar	Schedule		ð

- Activate the *Schedule* for the *Lighting*.
- Click on Figure and select the *Lighting* profile from the library. Double-click **Accept.**

Space (Туре 7)	×
Reference Dining	9
Space classification Occupied	
Calculation conditions Heated and cooled	Ī
Cooling Heating	
Design indoor temperature 24.0 °C Design indoor temperature 21.0 °C	
Design relative humidity 50.00 % Design relative humidity 30.00 %	
Ventilation/Infiltration	
Ventilation 5 (/s)/person - Infiltration	
Heat recovery	·
V Schedule	
✓ Internal heat gains	ī
People 1.4 m³/person - I Internal equipment	
Sensible heat gain 80.00 W/person Sensible heat gain 5.40 W/m² ▼	
Radiant fraction 0.58 💽 Radiant fraction 0.20]
Latent heat gain 80.00 W/person Latent heat gain 0.00 W/m² ▼	
☑ Schedule 🔄	
✓ Lighting Miscellaneous loads	
Sensible heat gain 8.60 W/m² 🔻	
Radiant fraction 0.58	
Soace fraction 0.69	
Schedule	
Accept	Cancel



5.10 Technical room

- Select the *Technical room* space type and click on **Edit**.
- Classify the space as *Non-habitable*.
- Type in the data according to the figure below.

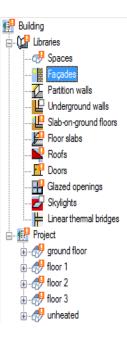
Space (Type 10)	×
Reference Technical room	-
Space classification Not occupied	4
Losses reduction factor 'b'	
Calculated	
© Custom	
Airtightness	
Completely airtight	
Without ventilation openings	
Small ventilation openings	
Permanent ventilation openings	
Large or numerous ventilation openings A second secon	
Custom	
Not airtight due to numerous open joints, or large or numerous permanent ventilation openings (10/h)	
Accept	ancel



6 Defining construction elements

6.1 Façades

Click on Façades.



6.1.1 Brick wall 13

• Double-click on it or, with the *Brick wall 13* type selected, click on **Edit**.

		Façade (Type 1)		C	ב	×
Reference Brick wall	13						4
Oetailed input	Simplified input						
🕒 🖊 🗋 🖨 🕇	} ↓						
L. Thickness (cm)	Conductivity (W/(m·K))	Thermal resistance (((m²·K)/W)	Density (kg/m³)	Specific heat capacity (J/(kg	·K))	4
Punctual thermal bridge	es (per m?) Linear thermal	bridge					
Х (W/K)	Туре		(V)	//(m·K))	Separation (cm)		
Absorptance					0.60	~	
Accept						C	ancel



• Click on **Representative wall types** and select option **13**. **Brick, insulation board, sheathing**... from the *Brick walls* group.

Representative wall types				x		
 Curtain walls Stud walls EIFS 	Import	Description 11. Brick, insulation board, sheathing, gyp board 12. Brick, sheathing, batt insulation, gyp board	U (W/(m²·K)) 0.571 0.377	^		
Brick walls Concrete block wall Precast and cast-in-place concrete walls		 Brick, insulation board, sheathing, batt insulation, gyp b Brick, insulation board, 200 mm LW CMU Brick, 200 mm LW CMU, batt insulation, gyp board 	0.283 0.581 0.348	¥		
Source: 2013 ASHRAE Handbook - Fundamentals						
Accept			Can	cel		

● Detailed input ○ Simplified input	t				
+ 🦉 📖 🗙 📥 🔻					
Layers	Thickness (cm)	Conductivity (W/(m·K))	Thermal resistance ((m ² ·K)/W)	Density (kg/m³)	Specific heat (J/(kg·K))
M01 - 100 mm brick	10.16	0.894	0.11	1920.00	790.00
F04 - Wall air space resistance	4.00	0.267	0.15	1.00	1008.00
101 - 25 mm insulation board	2.54	0.029	0.88	43.00	1210.00
G03 - 13 mm fiberboard sheathing	1.27	0.068	0.19	400.00	1300.00
104 - 89 mm batt insulation	8.94	0.046	1.94	19.00	960.00
G01 - 16 mm gyp board	1.59	0.160	0.10	800.90	1088.00
+ 🗗 🗙 👘 -	Linear thermal bridg + D X Type	25	(W/(m·K))		Separation (cm)



6.1.2 Brick wall 17

Double click on Brick wall 17 (or select it and click on Edit).

• Click on **Representative wall types** and select option **17**. **Brick, insulation board, brick** from the *Brick walls* group.

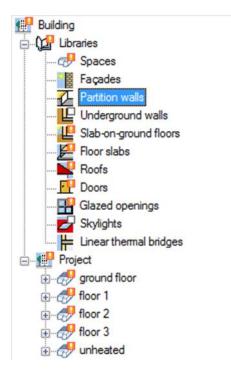
Representative wall types				×		
○ Curtain walls	Import	Description	U (W/(m²·K))	^		
○ Stud walls		16. Brick, insulation board, 200 mm HW CMU, gyp board	0.628			
○ EIFS	 Image: A start of the start of	17. Brick, insulation board, brick	0.702			
Brick walls		18. Brick, insulation board, 200 mm LW concrete, gyp board	0.514			
○ Concrete block wall		19. Brick, insulation board, 300 mm HW concrete, gyp board	0.581			
Precast and cast-in-place concrete walls		20. Brick, 200 mm HW concrete, batt insulation, gyp board	0.389	~		
Source: 2013 ASHRAE Handbook - Fundamentals						
Accept						

eference Brick wall 17					
Detailed input O Simplified inp	out				
+ 🤌 🖃 🗙 🔺 🔻					
Layers	Thickness (cm)	Conductivity (W/(m·K))	Thermal resistance ((m ² ·K)/W)	Density (kg/m³)	Specific heat (J/(kg·K))
M01 - 100 mm brick	10.16	0.894	0.11	1920.00	790.00
F04 - Wall air space resistance	4.00	0.267	0.15	1.00	1008.00
	0.54	0.029	0.88	43.00	1210.00
101 - 25 mm insulation board	2.54	0.029	0.00	45.00	1210.00
101 - 25 mm insulation board M01 - 100 mm brick	10.16	0.894	0.11	1920.00	790.00
M01 - 100 mm brick Punctual thermal bridges (per m ²)	10.16 Linear thermal bridg	0.894			
M01 - 100 mm brick	10.16	0.894			
M01 - 100 mm brick Punctual thermal bridges (per m ²)	10.16 Linear thermal bridg	0.894			
M01 - 100 mm brick Punctual thermal bridges (per m ²) +	10.16	0.894	0.11		790.00



6.2 Partition walls

Next, Partition walls will be defined.



6.2.1 Simple partition

- Double-click on **Simple partition** or click on **Edit**.
- Click on + Add and then on EN ISO 10456. Click on Gypsum and select *Gypsum* (*density 1200*). Select the white colour.
- Click on + Add to add a layer of material to the construction system. Click on Air cavity, type in 2.5 cm and click on Accept.
- With the *Gypsum layer* selected, dick on Copy to add an identical new layer.



		Partition wa	all (Type T)		
Reference Simple partition	on				
Detailed input					
🛨 💋 🗋 🖨 🕇	Thickness (cm)	Conductivity (W/(m·K))	Thermal resistance ((m²-K)/W)	Density (kg/m³)	Specific heat capacity (J/(kg
Gypsum (density 900)	10.00	0.30	0.333	900.00	1000.00
Air cavity	2.50	0.14	0.180	1.00	1008.00
Gypsum (density 900)	10.00	0.30	0.333	900.00	1000.00
•					4
Punctual thermal bridges					
🗄 💋 🗋	🗄 🗾 !				
X (W/K)	Туре		(W/(m·K))		Separation (cm)
Absorptance					0.60

• Click on **Export** to import to other walls and jobs later on.

6.2.2 Isolated partition

- Click on Find Import, select *Simple partition* and click on **Accept**. Change the name to "Isolated partition".
- Click on + Add and then on Sealant materials and select *Polyurethane (PU)*. Click on Accept. Select the yellow colour.

Materials described in	the EN ISO 10456 code	×
Asphalt Bitumen Concrete Roor coverings Gases Glass Water Metals Plastics, solid Rubber Sealant materials, weather stripping and themal breaks Gypsum Plasters and renders Soils Stone Tiles (roofing) Tiles (other) Tiles (other) Timber	 Silica gel (dessicant) Silicone, pure Silicone, filed Silicone foam Urethane/polyurethane (thermal break) Polyvinylchloride (PVC) flexible, with 40% softener Elastomeric foam, flexible (density 60) Elastomeric foam, flexible (density 80) Polyurethane (PU) foam Polyurethane foam 	
Accept	C	Cancel



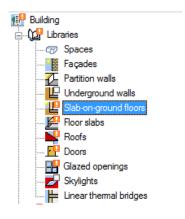
		Partition wall (Туре 2)			×
Reference Isolated partition	1					-
 Detailed input Si Image: Image: Image:						4
Layers	Thickness (cm)	Conductivity (W/(m·K))	Thermal resistance ((m²-K)/W)	Density (kg/m³)	Specific heat capacity (J	4
Gypsum (density 900)	10.00	0.30	0.333	900.00	1000.00	
Polyurethane (PU) foam	10.00	0.05	2.000	70.00	1500.00	
Air cavity	2.50	0.14	0.180	1.00	1008.00	
Gypsum (density 900)	10.00	0.30	0.333	900.00	1000.00	
← Punctual thermal bridges (pe ⊥	rm?) Linearthermai	_			•	
Х (W/K)	Туре		(W/(m·K))	Se	eparation (cm)	
Absorptance					0.60	
Accept					C	ancel

• Move it with the arrow ᅌ until it is in second place.

• Click on 🗾 **Export** to import to other walls and jobs later on.

6.3 Slab-on-ground floors

• Click on Slab-on-ground floors.





6.3.1 Screed

Double-click on **Screed**.

• Click on + Add and then on the Section EN ISO 10456 material. Click on Concrete and then select *Reinforced (with 1% of steel)*. Type in *20 cm*.

Materials described in t	the EN ISO 10456 code	×
Asphalt	Medium density (density 1800)	
Bitumen	Medium density (density 2000)	
Concrete		
Floor coverings	Medium density (density 2200)	
Gases	High density	
Glass	Reinforced (with 1% of steel)	
Water	 Reinforced (with 2% of steel) 	
Metals	O Heinibiced (with 2 % of steel)	
Plastics, solid		
Rubber		
Sealant materials, weather stripping and thermal breaks		
Gypsum		
Plasters and renders		
Soils		
Stone		
Tiles (roofing)		
Tiles (other)		
Timber		
Wood-based panels		
Accept		Cancel

• Click on + Add and then on the Set ISO 10456 material. Click on Plastics, solid and select *Polyethylene/polythene, low density*. Set the *Thickness* to 0.2 cm. Click Accept.



	Materials described in t	the EN ISO 10456 code	×
Sealant t	Asphalt Bitumen Concrete Floor coverings Gases Glass Water Metals Plastics, solid Rubber materials, weather stripping and thermal breaks Gypsum Plasters and renders Soils Stone Tiles (roofing) Tiles (ther) Timber Wood-based panels	 Acrylic Polycarbonates Polytetrafluoroethylene (PTFE) Polywinylchloride (PVC) Polymethylmethacrylate (PMMA) Poyacetate Polyamide (nylon) Polyethylene/polythene, hith density Polyethylene/polythene, hith density Polyethylene/polythene, low dem Polyethylene Polypropylene Polypropylene with 25% glass fibre Polyurethane (PU) Epoxy resin Phenolic resin Polyester resin 	sity
Ассер	A.		Cancel
	Lay Reference Polyethylene/polythene, Type of layer Thickness Density Conductivity Thermal resistant Water vapour diffusion resistance fact Colour Mesh	Iow density Solid ~ 0.20 cm 920.00 kg/m ³ 0.330 W/(m.K) 2200.00 J/(kg.K)	
	<u>A</u> ccept		Cancel

• Click on + Add and then on • Representative materials. Click on Insulating and select *103 – 75 mm insulation board*.

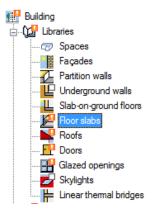


• Activate the **with edge insulation** option. Select *Horizontal* as the *Type of insulation*. Type in *1.35 m²K/W* for *Thermal resistance*. Type in *1.0 m* for *Thickness or depth*.

		Slab-on-groun	nd floor (Type 1)			
Reference Screed						
● Detailed input (+ 🤌 📄 🗙 🔺		t				
Layers	Thickness (cm)	Conductivity (W/(m·K))	Thermal resistance ((m ² ·K)/W)	Density (kg/m³)	Specific heat (J/(kg·K))	
Concrete. Reinforc	20.00	2.300	0.09	2300.00	1000.00	
Polyethylene/poly	0.20	0.330	0.01	920.00	2200.00	
103 - 75 mm insula	7.62	0.029	2.63	43.00	1210.00	
Punctual thermal brid	ges (per m²)	Linear thermal bridges				
+ 🗗 🗙		+ 🗗 🗙				
X (W/K)		Туре	(W/(I	(W/(m·K)) Separation (cm		
Туре				S	lab-on-ground floor 🗸	
With edge insulatio	n					
Type of insulation				Horizo	ntal 🗸	
Thermal resistance					1.35 (m²·K)/W	
Thickness 5.00 cm						
Thickness or depth 1.00 m						
Soil thermal conductiv	rity				2.000 W/(m·K) 🖕	
<u>A</u> ccept						Can

6.4 Floor slabs

Click on Floor slabs.





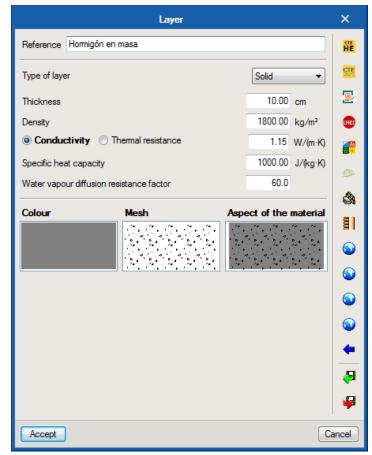
6.4.1 Floor slab

• Click on + Add and then on the Section EN ISO 10456 material. Click on Floor coverings and Linoleum. Set the *Thickness* to 0.2 cm.

Materials described in t	the EN ISO 10456 code	×
Asphalt Bitumen Concrete Hoor coverings Gases Glass Water Metals Plastics, solid Rubber Sealant materials, weather stripping and thermal breaks Gypsum Plasters and renders Soils Stone Tiles (roofing) Tiles (other) Timber Wood-based panels	 Rubber Plastic Underlay, cellular rubber or plastic Underlay, felt Underlay, wool Underlay, cork Tiles, cork Carpet/textile flooring 	
Accept		Cancel

- Click on + Add and then on the EN ISO 10456 material. Click on Concrete, Medium density 1800). Set the *Thickness* to *8.0 cm*, change the *Colour* and *Mesh* according to the figures below.
- Click on 📕 **Export**, type in the *File* name *"Mass concrete"*.







- Click on + Add and then on the Section EN ISO 10456 materials. Click on Concrete, Reinforced (with 1% of steel). Set the *Thickness* to 20 cm.
- Click on + Add and then on Air cavity, change the Air cavity to Not ventilated and the Layout to Vertical and set the Thickness to 30 cm.
- Click on + Add and then on the Section EN ISO 10456 materials. Click on Gypsum, Gypsum plasterboard (density 700). Set the *Thickness* to 1.5 cm.
- Click on 差 **Export** to import to other spaces and jobs later on.

Internal floor slab (Type 1)					×		
Reference Floor slab							
Detailed input Simplified input Image: Simplified input Image: Simplified input	 ● Detailed input ○ Simplified input ▲ I ▲ 						
Layers	Thickness (cm)	Conductivity (W/(m·K))	Thermal resistance ((m²-K)/W)	Density (kg/m³)			
Linoleum	0.20	0.17	0.012	1200.00			
Hormigón en masa	8.00	1.15	0.070	1800.00			
Concrete. Reinforced (with 1% of steel)	20.00	2.30	0.087	2300.00			
Air cavity	30.00	1.67	0.180	1.00			
Gypsum plasterboard (density 700)	1.50	0.21	0.071	700.00			
•				+			
Punctual themal bridges (per m?) Linear themal bridge							
X (W/K) Type	е	(W/(m·K)) Separat	tion (cm)			
Absorptance				0.60			
Accept				C	Cancel		

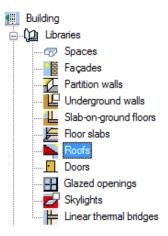
6.4.2 External floor slab

- Click on Figure 1 (Click on Accept. Change the name to "External floor slab".
- Delete the gypsum and air cavity layers.



6.5 Roofs

Click on Roofs.



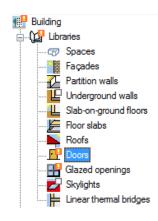
- Click on + Add and then on Section EN ISO 10456. Click on Tiles (other) and Ceramic.
 Type 1 cm into Thickness.
- Click on Add and 🐖 Import, select Mortar.
- Click on + Add and then on Section EN ISO 10456. Click on Plastics, solids, and Polyester resin, 0.10cm Thickness, green Colour.
- Click on + Add and then on EN ISO 10456. Click on Sealant materials, weather stripping and thermal breaks and Polyethylene foam. 8 cm Thickness, yellow Colour.
- With the *Polyester resin* layer selected, click on Copy to add an identical new layer.
- Click on + Add and then on ^{See} EN ISO 10456. Click on Asphalt, 0.40cm Thickness, black Colour.
- Click on + Add and then on Air cavity, change the Air cavity to Not ventilated and the Layout to Vertical and set the Thickness to 30 cm.
- Click on + Add and then on the end of the ISO 10456 materials. Click on Gypsum, Gypsum plasterboard (density 700). Set the *Thickness* to *1.5 cm*.



● Detailed input ○ Simplified inp	put				
Layers	Thickness (cm)	Conductivity (W/(m·K))	Thermal resistance ((m²-K)/W)	Density (kg/m³)	Specific heat capacity (J/(kg·K))
Ceramic/porcelain	10.00	1.30	0.077	2300.00	840.00
Mortar	0.80	1.00	0.008	1800.00	1000.00
Polyester resin	0.10	0.19	0.005	1400.00	1200.00
Polyurethane (PU) foam	8.00	0.05	1.600	70.00	1500.00
Polyester resin	0.10	0.19	0.005	1400.00	1200.00
Asphalt	0.40	0.70	0.006	2100.00	1000.00
Air cavity	20.00	0.89	0.225	1.00	1008.00
Gypsum plasterboard (density 700)	1.50	0.21	0.071	700.00	1000.00
	ear thermal bridge		(W/(m·K))		Separation (cm)
Absorptance					0.60

6.6 Doors

Click on Doors.



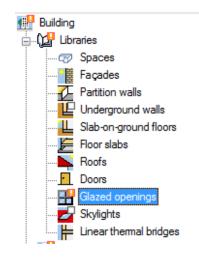
- There are two door types to be defined.
- Double click or click on edit with the door selected, and type *2.030* into the *Heat transfer coefficient*, for each one of them.

	Do	oor (Type 1)				×
Reference	Internal door					æ
Heat transfe	er coefficient		2.030	W/(m²·K)		4
Absorptanc	•		0.60	[←	
Accept					Са	ncel



6.7 Glazed openings

Click on *Glazed openings*.



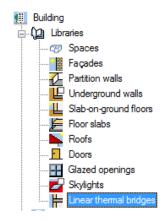
• Double click or click on **Edit** for each one of them, and type 2 into the *Heat transfer coefficient*, in each of them.

Glazed opening (Type 1)	×
Reference Window 2	
Glazed fraction Opaque fraction External shading Internal shading	P
Heat transmission coefficient 🗸 U 📓 W/(m²K)	
Center-of-glazing solar heat gain coefficient, SHGC	
Normal incidence 0.70	
Accept	Cancel



6.8 Linear thermal bridges

Click on Linear thermal bridges.



All detected *Edges* with a default value of 0.5 in the *Psi* are displayed, and their values can be confirmed or changed by the user.

+	1 🗋	🖻 🖉 🗣 🖗				
		Reference	Psi	Value	In use	-
1	н.	LFi [E]Screed-[B]Brick wall 13(90)	0.50	Not defined		
2	1	LFi [E]Screed-[B]Brick wall 17(90)	0.50	Not defined		
3	•	LFi [M]External floor slab-[B]Brick wall	0.50	Not defined		
4	2	LFi [F]Floor slab-[C]Isolated partition(90)	0.50	Not defined		Ξ
5	2	LFi [F]Floor slab-[C]Simple partition(90)	0.50	Not defined		
6	E.	LFs [G]Concrete roof 19-[B]Brick wall	0.50	Not defined		
7	?	LFs [F]Floor slab-[C]Isolated partition(90)	0.50	Not defined		

The definition of a linear thermal bridge can be manual or automatic. A manual definition can be carried out by editing the linear thermal bridge and filling in the corresponding heat transfer coefficient; there are predefined libraries for importing values.

	Linear thermal bridge (Type 1)			×
			ì	æ
Reference	LFi [E]Screed-[B]Brick wall 13(90)		🖕 CTE DB-HE	
Description		*	누 ISO 14683	÷
			🖕 ISO 10211	
Psi	0.50 W/(m·K)	*	💠 RT Existant	
Value	Not defined	•	4 RT 2012	
Accept			Ca	ancel



Automatic configuration is described as follows.

• In the (wider) ribbon toolbar, click on the **Edges** icon.

	Edges processing X	
	Linear themal bridge analysis to calculate the corresponding transmittance, depending on the characteristics of the adopted construction solutions. This analysis will be carried out taking into account the specifications that are applicable depending on the code that has been selected to calculate the themal transmittance in linear themal bridges. The import of building information models (BIM) focuses on the geometric description of the building; their technical information is introduced using specific software. Therefore, to detect linear thermal bridges, the program must carry out a two-step process. For the first step, 'Edges' are imported as purely geometric entities, obtained from the intersection of various construction elements. In the second step 'Edges processing' linear thermal bridges are obtained from the edges, taking into account the building description from a thermal analysis point of view (zones, space description, etc.) Configuration Do you wish to continue?	
Accept	Cancel	

• Click on **Configuration** and fill in the data according to the figure below. Click **Accept**.

Configuration X
Code ISO 14683
EN ISO 14683. Thermal bridges in building construction. Linear thermal transmittance. Simplified methods and default values.
The values suggested in the code are used as reference for the linear thermal transmittance coefficient for the different thermal bridges, taking into account the configuration for the constructive elements that make them up.
Alignment of the frame of the opening with respect to the façade Internal face 💌
The insulation of the façade reaches the frame of the opening
Front of the slab with insulation
Numerical analysis of linear thermal bridges (EN ISO 10211) Module developed as part of the 'Development of a software tool for the integration of the numerical analysis of thermal bridges in the analysis of building energy demand' investigation project, financed by the 'Centro para el Desarrollo Tecnológico Industrial (CDTI)', and co-financed by the 'European Regional Development Fund (ERDF)' and carried out in collaboration with the 'Grupo de Ingeniería Energética' of the 'Departamento de Sistemas Industriales' of Miguel Hernández University of Elche (Alicante).
Manual definition of the linear thermal transmittance coefficient
Accept Cancel



		Edges processing		×
	Reference	Description	Psi	-
1.	LFi [E]Screed [B]Brick wall 13(90)	GF1. Screed in contact with the soil.	Thermal bridges in building construction. 0.800 Linear thermal transmittance. Simplified methods and default values.	H
2.	LFi [E]Screed [B]Brick wall 17(90)	GF2. Screed in contact with the soil.	Thermal bridges in building construction. 0.750 Linear thermal transmittance. Simplified methods and default values.	
3.	LFi [E]Screed [B]Brick wall 17(90)	GF2. Screed in contact with the soil.	Thermal bridges in building construction. 0.750 Linear thermal transmittance. Simplified methods and default values.	
4.	LFi [M]External floor slab [B]Brick wall 13(90)	Raised floor slab This type of themal bridge is not taken into account by the code. In this case, a default value is assumed for the linear transmission.	0,500 Default value.	
5.	LFs [G]Concrete roof 19 [B]Brick wall 13(90)	Roof This type of thermal bridge is not taken into account by the code. In this case, a default value is assumed for the linear transmission.	0,500 Default value.	
6.	TFs [G]Concrete roof 19 [G]Concrete roof 19(180) [B]Brick wall 13(90)	Roof This type of thermal bridge is not taken into account by the code. In this case, a default value is assumed for the linear transmission.	0,500 Default value.	
7	TFmi [F]Floor slab	Intermediate floor slab	n con Default volue	- -
	Accept			incel

The *Edges processing* window appears with the calculation of the *Psi*.

• Once we accept, the *Update process results* window appears.

Update process results X						
Edges	796					
Useful	222					
Deleted	574					
Recovered	-					
Modified	222					
Accept						

In the structure, in *Project*, the spaces are grouped together. Inside each space, their construction elements and linear thermal bridges can be found.

When selecting a space, the *Installed power* of the *Lighting* for that specific space can be defined. When the programme carries out the thermal load calculation, it will use this value, ignoring the one entered in the space type.

This value can be entered either manually or by importing a BIM lighting model.



📱 Building	Space
Building Ubraries Comparison Spaces Pacades Partition walls Underground walls Slab-on-ground floors Floor slabs	Space Reference Dining room Type 7: Dining • Area 50.5 m ² Volume 171.90 m ³ Lighting
Roofs Roofs Clazed openings Skylights Hunesthemal bridges ()	installed power

7 Defining the Calculation model

Click on the Thermal loads tab.

7.1 Location data

• Click on **Location data**. The configuration window for *Location data* and the heating and cooling *Design conditions* will appear.

Location						
titude	38.2	28 ° Foreground solar i	eflectance			0.20
ngitude	-0.5	55 ° Time zone				1.0
vation	31.0	00 m 🔽 Daylight saving	g time (DST)	Fir	st month April 💌	Last month October 💌
ting design conditions						
-bulb temperature	4.8 °C	Relative humi	dity 80.0 %		Ground temperature 1	3.0 °C
ling design conditions						
Monthly cooling load loulations performance	Design dry-bulb temperature (°C)	Mean coincident wet-bulb temperature (°C)	Daily dry-bulb temperature range (°C)	Daily wet-bulb temperature range (°C)	Clear sky optical depth for beam irradiance	Clear sky optical depth for diffuse irradiance
January	19.8	12.5	9.4	6.3	0.334	2.395
February	21.1	13.2	9.6	6.7	0.366	2.215
March	23.2	14.3	9.9	6.5	0.411	2.038
April	24.0	15.1	9.9	6.0	0.443	1.954
May	26.4	17.5	9.3	5.4	0.496	1.834
June	30.6	20.0	9.2	5.4	0.537	1.757
July	32.2	21.7	8.9	5.8	0.559	1.717
August	32.9	22.1	8.9	5.6	0.533	1.788
September	31.0	21.1	9.2	5.9	0.484	1.901
October	27.2	19.3	9.3	5.6	0.415	2.094
November	23.7	16.1	8.9	5.8	0.366	2.266
December	20.0	13.5	9.1	5.9	0.339	2.367



Data can be changed manually or saved data can be imported from the library. In this example, the ASHRAE database will be used.

• Click on the ASHRAE Weather Data Viewer icon and select the data shown in the figure.

	Import	×		
AS	shrae Z			
	WMO region	4 - NORTH AND CENTRAL AMERICA		
®	Country	United States ~		
	State/Province	Georgia ~		
ASHRAE	Station name	ATLANTA HARTSFIELD-JACKSON		
	Annual percentile v	alue (Heating) 99% ~		
	Annual percentile v	alue (Cooling)		
	Annual temperat	tures 1% ~		
Weather Data Viewer 6.0.	Monthly temper	atures 2% ~		
2017 ASHRAE, www.ashrae.org	Latitude (°)	33.64 N		
Used with permission.	Longitude (°)	84.43 W		
	Altitude	313.00 m		
The data are provided "as is" without warranty of any kind, either expressed or implied. The entire risk as to the quality and performance of the data is with you. In no event will ASHRAE be liable to you for any damages, including without limitation any lost profits, lost savings, or other incidental or consequential damages arising out of the use or inability to use the data.				
Accept		Cancel		

• Click **Accept** to import the selected data.



			Location da	ta			×
Location ATLANTA HAR	rsfield-jackson						Ť
Latitude Longitude	-84.4		r reflectance			0.20	
Elevation	313.0	0 m 🗹 Daylight savir	ng time (DST)	Fir	rst month April ~	Last month October	
Heating design conditions							
Dry-bulb temperature	-3.00 °C	Relative hur	nidity 80.0	%	Ground temperature	7.76 °C	
Cooling design conditions							
Monthly cooling load calculations performance	tomporature	Mean coincident wet-bulb temperature (°C)		Daily wet-bulb temperature range (°C)	Clear sky optical depth for beam irradiance	Clear sky optical depth for diffuse irradiance	^
January	19.00	14.80	9.60	7.50	0.31	2.538	
February	20.60	14.90	10.10	7.40	0.315	2.521	
March	25.00	15.90	10.70	6.10	0.347	2.453	
April	27.80	18.30	11.00	5.30	0.386	2.324	
May	30.60	21.00	10.10	4.20	0.44	2.213	
June	33.30	22.70	9.50	3.70	0.473	2.168	
July	34.50	23.70	9.30	3.40	0.515	2.066	
August	34.30	23.70	9.10	3.40	0.515	2.052	
September	31.70	21.90	9.20	3.80	0.417	2.312	
October	27.10	19.30	10.10	5.00	0.363	2.46	
<u>A</u> ccept							Cancel

7.2 Calculation options

• Now, dick on ⁽²⁾ Calculation options.

Calculation options	×
Heating loads calculation	
Analysis method	
Safety factor	
Orientation safety factor	
Cooling loads calculation	
Annual 🔻	
Latent cooling factor	
Sensible cooling factor	
Save as default settings	
Accept Default settings Cano	el



In this dialogue box, the calculation options for calculating thermal loads can be modified. In the calculation for heating thermal loads, the EN 12831 code or ASHRAE standard can be selected. In the cooling thermal load calculation, the programme uses the ASHRAE method.

• Click on **Accept** to keep the default settings. The aim is to define the zones and corresponding spaces.

7.3 Hypothesis and Thermal zones

• Click on Hypothesis, maintain the *Reference* and click **Accept**.

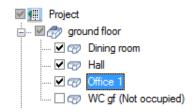
Edit	×
Hypothesis	
Reference Hypothesis 1	
Accept	Cancel

In this example, one zone will be created for the ground floor, and another will be created for the remaining offices.

• Click on **Circle Zone**, and type *"Zone Ground Floor"* into the *Reference*.

	Edit	×
Zone		
Reference	Zone Ground Floor	
Space selection	6	
Accept		Cancel

• To select the spaces that will be included in this zone, click on **Space selection**, and select only the spaces that will be air-conditioned on the ground floor.





• The aim here is to create a new zone. Select *Hypothesis 1* from the list. Click on **Zone**. Enter a *Reference* (i.e., *Zone Offices*).

	Edit	×
Zone		
Reference	Zone Offices	
Space selection	è	
Accept		Cancel

• Click on **Space selection** and mark all the offices and meeting rooms.

Space selection	×
M 🚛 Project	
ground floor (Partially included in: Zone Ground Floor)	
Dining room (Included in: Zone Ground Floor)	
🗌 🖅 WC gf (Not occupied)	
🖕 🐨 🜌 🥏 floor 1	
🗹 🌝 Office 2	
🗹 🖅 Meeting room	
🗹 🖅 Office 3	
WC 1f (Not occupied)	
🗹 🖅 Office 4	
🗌 🖅 Comidor (Not occupied)	
🖶 🐨 🜌 🧒 floor 2	
🗹 🖅 Office 5	
🗹 🖅 Meeting room 2	
🗹 🖅 Office 7	
🖸 🌝 WC 2f (Not occupied)	
🗹 🖅 Office 6	
Corridor 2 (Not occupied)	
····· 🗹 🐨 Office 8	
🗹 🐨 Office 10	
🖸 🦁 WC 3f (Not occupied)	
····· ☑ 🐨 Office 9	
Lift (Not occupied)	
C P Risers (Not occupied)	
Complete (Volt occupied)	
Accept	Cancel

The model of the building has been fully defined.

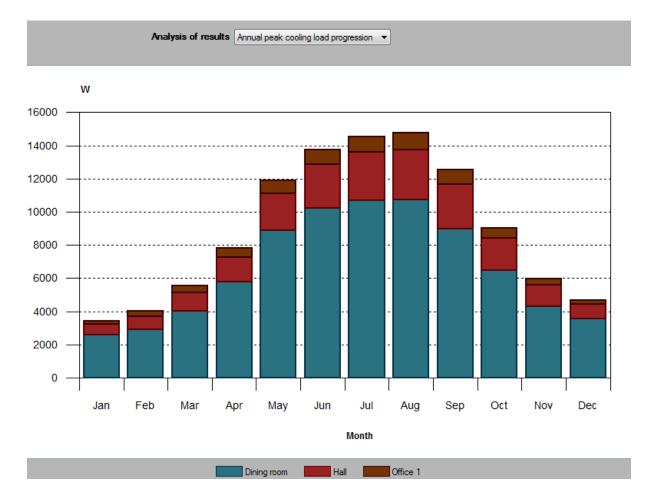


8 Calculation and analysis of results

8.1 Update results

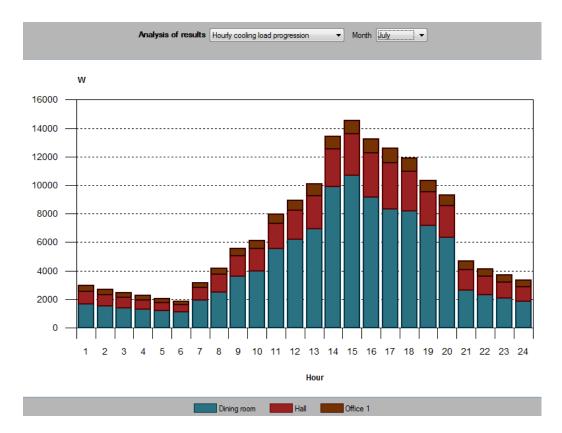
To either carry out or update the analysis of results, click on the \blacksquare **Update results** icon. After the calculation, users will be able to analyse the calculated values.

Click on **Ground Floor Zone** in the list to check the *Annual peak cooling load progression*, for example.

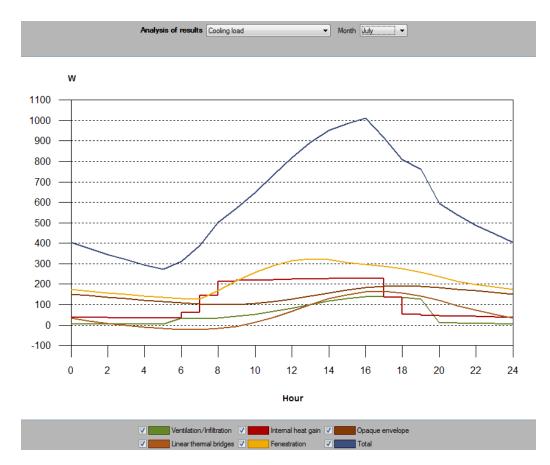


Clicking on the **Analysis of results** list, other data can be checked, such as the *Hourly cooling load progression*.





More data can be checked by dicking on the *Office 1* space.





8.2 List of results and complementary reports

To check the thermal load calculation result, click on **List of thermal loads**. In the pop-up panel, the content of the list can be selected. A summary of the results and the spaces of each zone to be included in the report can be selected as well as the possibility of including *Graphs*:

List of thermal loads		×
 Zone hypothesis Hipothesis 1 Thermal load summary report 2 ne Ground Floor 2 ne Offices 	Report de	
Accept	Ca	ncel

The complete list of thermal loads for the two zones can also be accessed by selecting *Hypothesis 1* from the list and clicking **Complete report.** If you wish to view only one zone, click on the desired zone and then on **Complete report**.

For each level of the list, the programme includes a report where the methodology used in the implemented calculations is displayed. To view it, select the **Calculation description** option in the *Analysis of results* section.

Clicking on the **Additional reports** icon in the top toolbar, the *Description of materials and construction elements* and *Calculation of the reduction factor* documents can be checked.

Reports	
	F
Description of materials and construction elements	Calculation of the reduction factor
Accept	Cancel



9 Updating and exporting the BIM model

Any changes in the BIM model of the building can be reflected in the calculation model via the update function. If the programme detects that the BIM model has been modified, the

Update option will alert users by flashing the following icons 0 (8 .

In this case, in order to proceed with the update, click on 🮯 **Update**.

		Update BIM model				×
Project selection	Project: Offi	server.center ces - Practical example ces Architectural Model.ifc		R		
Select the	files you want to includ	e				
Import	Application/Program	Project	Description	Date	Change	s
✓	CYPELUX	Offices - Practical example CYPELUX	CYPELUX	2021/10/21 09:20:58		
Edges / Sh	ading generation					
🗹 Import	t edges				0	
		on in the external elements			0	
🗹 Even if	f they have been modifi	ed				
Locatio	on data Northern hem	nisphere 🗸				
🗸 Use	the location of the BIN	1 model, if it is defined.				
						1
	Geographic location and reference sy				ence syst	em
Accept]				Can	cel

The programme will indicate whether or not the project has been modified at the top. During the update process, the actions to be carried out for new, modified, or deleted elements can be parameterised. The typologies of construction systems, edges and shading can also be updated via the BIM model update.

For exporting the thermal load values in an IFC file format, in order for them to be imported into the CYPETHERM HVAC programme, for example, or into any other Open BIM programme, the following process must be followed.



Click on the 🧭 Share icon.

Export in 'IFC' format	×
Using this option, a file is generated containing the thermal load results for each space in 'IFC' format, linked to the BIM model of the building.	
File name	
Offices Architectural Model CYPETHERM LOADS	
Attached description	
	*
	Ŧ
Accept	Cancel

This way, an IFC file with the thermal loads of each space in the building is exported to the relevant project in BIMserver.center.

If the project is updated, a new export must be made by updating the information present in the IFC file.

The information generated by CYPETHERM LOADS can be used by other programmes. For example, HVAC design programmes integrated into the Open BIM workflow via the BIMserver.center programme can import the calculated thermal loads for the installation design.